Mosquito Frequency and Feeding Habits in an Enzootic Canine Dirofilariasis Area in Niterói, State of Rio de Janeiro, Brazil

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Heartworm, a chronic fatal mosquito-borne canine disease, is frequently diagnosed in dogs from the State of Rio de Janeiro, where its prevalence is 29.7% in the city of Niterói. Nevertheless it is rarely detected in cats (0.8%) from the same state. Dogs are the primary source of infection to mosquitoes, because cats either do not demonstrate microfilaremia or it is too low and transient for transmission. A mosquito survey was conducted in Itacoatiara, Niterói, from March 1995 to February 1996, using canine, feline and human baits. A total of 21 mosquito species (3,888 females) was collected and biting frequency was highest at dusk. The four species collected most frequently (88.9%) were: Aedes taeniorhynchus *(30% of the total catch; with the peak in May/June);* Culex quinquefasciatus *(22.5%; August/October);* Aedes scapularis *(19.4%; August, October/November and January) and* Culex declarator *(17%; November/January). Human baits were attractive to these species and dogs were significantly more attractive to them than cats.* Ae. taeniorhynchus, Cx. quinquefasciatus, Ae. scapularis, Cx. declarator and Cx. nigripalpus *are the most likely mosquito species to transmit* Dirofilaria immitis *parasites to dogs and may transmit the parasite to humans. It is also suggested that the vector to cats belongs to the genus* Culex.

Key words: *Dirofilaria immitis* - heartworm - mosquito frequency - mosquito feeding habits - canine - feline

Dirofilariasis (*Dirofilaria immitis* Leidy) is a widely spread mosquito-borne nematodiasis of dogs and cats. Canine heartworm is enzootic in many areas worldwide (Guerrero et al. 1992a). However, while feline dirofilariasis is much less common, it is thought to be increasing in prevalence and distribution (Guerrero et al. 1992b). Presently it is accepted that feline heartworm infection parallels that of dogs in a given area, although at a lower infection rate (Dillon 1988, Elkins & Kadel 1988), even though cats are considerably susceptible to infection under experimental conditions (McCall et al. 1992).

Dogs are considered to be the primary source of infection to mosquitoes because cats either do not demonstrate microfilaremia or it is too low and transient for them to be considered efficient reservoirs (Donahoe 1975, Wong et al. 1983, Dillon 1986). Therefore, the heartworm's life cycle is dependent upon microfilaremic dogs, abundance of competent vectors, favorable environmental conditions and a susceptible population of definitive hosts (Genchi et al. 1992, Guerrero et al. 1992b, Knight & Lok 1995).

Over 60 mosquito species have been shown to be able to transmit *Dirofilaria immitis* under experimental or natural conditions (Ludlam et al. 1970). In Brazil, few studies on heartworm vectors have been conducted. *D. immitis* can develop infective larvae in *Aedes fluviatilis* (Lutz) under laboratory conditions, although it is not likely to be an efficient vector in nature (Kasai & Williams 1986). Nevertheless, in an enzootic area in the city of Rio de Janeiro, 569 mosquitoes belonging to 20 species were dissected by Lourenço-de-Oliveira and Deane (1995) and two of them were found naturally infected by *D. immitis*-like larvae*:* one *Ae. scapularis* (Rondani) contained a single sausage-stage larva in the Malpighian tubules and one *Ae. tae-niorhynchus* (Wiedemann) had five third stage larvae in the lumen of the tubules. Based on these data, these two species were recognized as likely vectors in the study area. Further, it was suggested that field studies to determine the mosquito species attracted to dogs should be conducted in enzootic areas, as well as studies to determine the

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Received 20 May 1997
Accepted 12 November 1997

susceptibility of these mosquitoes to *D. immitis* parasites.

It is well documented that mosquito species populations have blood feeding preferences. Some mosquito species are very restrictive and will feed only on certain hosts while others are catholic and will choose upon their preference according to host abundance (Deane 1951, Edman & Bidlingmayer 1969, Aragão 1975, Forattini et al. 1987a). In Brazil, for instance, it has been shown that *Culex quinquefasciatus* Say, an endophilic and synanthropic species, feeds on mammals and birds and that among those hosts it has a preference for feeding on humans, although they frequently feed on dogs and less frequently on cats (Deane 1951, Rachou 1956, Forattini et al. 1987a). *Ae. scapularis* was also shown to feed on human, canine and feline hosts, besides being regarded as a hemisynanthropic species (Forattini et al. 1987b, 1993, 1995).

It has been proposed that mosquitoes which serve as vectors for *D. immitis* may have a low preference for cats or that cats do not tolerate mosquito bites as well as dogs do, which would decrease the probability for cats to become infected (Donahoe 1975). In a heartworm enzootic area of Italy, dogs and cats were compared for their attractiveness to mosquitoes. It was shown that the largest numbers of captures were always from dog: 1,396 mosquitoes captured in the dog-baited trap and 338 in the cat-baited trap (Genchi et al. 1992).

In the State of Rio de Janeiro, heartworm is frequently diagnosed in dogs, where its prevalence is 29.7% in the city of Niterói and 14% in the city of Rio de Janeiro (Labarthe et al. 1997a). On the other hand, it is rarely reported in cats from the State, where the known prevalence is 0.8% (Labarthe et al. 1997b).

Because (1) an evaluation of mosquito preference between dogs and cats has never been conducted in heartworm endemic areas of Brazil, (2) cats are susceptible to *D. immitis* infection even if they are infected at a lower level than dogs are, and (3) it seems like there is a mosquito host preference that can determine such a difference in infection rate, a longitudinal year-round study was initiated to elucidate mosquito host preferences and biting frequencies for dogs and cats, as well as humans.

MATERIALS AND METHODS

Mosquitoes were collected in Itacoatiara, in the municipality of Niterói, Brazil (22°.55'S 43°.03'W), a coastal residential district along a 700 m beach and settled on a narrow strip of level land of quaternary sedimentation surrounded by mountains. The area is characterized by lagoons, closed by barrier bars, that straighten the coastline (Fig. 1). The mountain vegetation is composed of patches of primary and secondary rain forest while the low land is mostly covered by barrier beach vegetation. From March 1995 until February 1996, mosquitoes were captured four days each month using a black and white female dog (7 kg), a black and white female cat (3.5 kg) and two human volunteers.

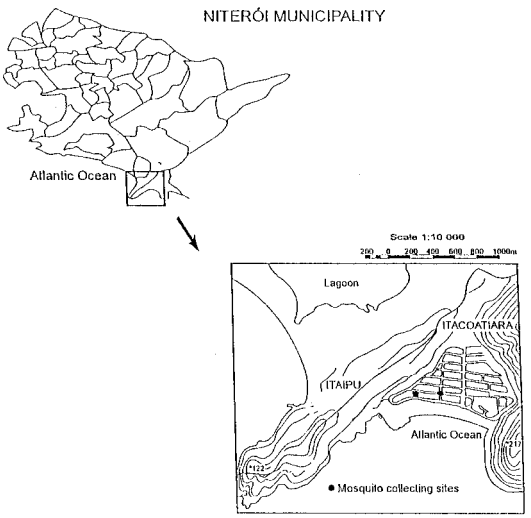

Fig. 1: map showing the study site. Further information upon geographical localization can be found in Labarthe et al. (1997a).

One dog- and one cat-baited wooden mosquito trap (75x100x120 cm), were designed with two Egyptian type baffles (Bates 1949) on each side (allowing diffusion of host emanations to the environment) with associated horizontal slots to allow mosquitoes to enter the trap. The traps were operated for 3 hr during dawn (starting at daybreak) and dusk (starting 30 min before sunset). The dog and the cat were kept in individual traps, but protected from mosquito bites in an inner restraining wire cage (50x50x50 cm) entirely covered by mosquito net and suspended 45 cm from the cage floor. The two traps were placed 25 m apart, outside a residence. Every collection day, the position of the dog- and the cat-baited mosquito traps were interchanged. After the 3 hr collection period, the animals were carefully removed from the traps and the trapped mosquitoes were collected with aspirators. Half an hour after setting the traps, two humans stood outdoors, about 200 m from the dog- and cat-baited traps, and captured mosquitoes directly from their own bodies for 1 hr. In the afternoon (1:00-3:00 p.m.), mosquitoes were captured while landing on the dog, cat or humans. During this collection period, the dog and the cat were kept

in separate wire cages, with the human volunteers outside and collecting mosquitoes off themselves and the animals concurrently.

Mosquitoes were kept in carton cages of 8.5cm diameter at 28°C, 80% relative humidity and provided a 10% glucose solution. After being anesthetized with chloroform vapor, they were identified using taxonomic keys of Lane (1953) and Consoli and Lourenço-de-Oliveira (1994). Identifications were confirmed by comparison with reared adult specimens with associated immature stages, collected in the study area. Monthly rainfall and temperature data were obtained from the Instituto Nacional de Meteorologia, from the Maricá station (22°.55'S 42°.49'W).

For the statistical analysis, only mosquitoes showing an overall frequency higher than 1% were considered. The frequency distribution was used to analyze the discrete data, the Z test was used to compare two proportions (Rodrigues 1993) and the Williams' mean to analyze serial data (Williams 1937, Haddow 1954, 1960).

RESULTS

A total of 3,888 female mosquitoes belonging to 21 species were collected from the three different baits (Table I). Species collected more frequently than 1% were compared to each other. The species most frequently collected in decending order were: *Ae. taeniorhynchus*; *Cx. quinquefasciatus*; *Ae. scapularis*; *Cx. declarator*; *Cx. nigripalpus*; *Ae. albopictus* and *Wy. bourrouli*. Their frequencies and Williams' means demonstrate large distribution differences between *Ae. taeniorhynchus* and *Wy. bourrouli* (Tables II, III, IV, Fig. 2).

Dogs were significantly more attractive than cats to *Ae. taeniorhynchus*, *Cx. quinquefasciatus*, *Ae. scapularis*, *Cx. declarator* and *Cx. nigripalpus*. More *Ae. albopictus* and *Wy. bourrouli* were collected on cats than dogs, although these mosquitoes were rarely caught on either bait and their low number of captures did not allow statistical treatment. The seven above mentioned species were also caught from the two humans, but due to methodological differences these data were not compared statistically to the animal baits (Table V). All seven species, except *Wy. bourrouli*, were more active during dusk than the other collecting times, and none of the *Culex* species was seen attacking any of the baits during the afternoon (Tables VI,VII).

When the Williams' means of the seven most frequent mosquito species were correlated with the mean temperature, only *Ae. albopictus* showed a

TABLE I

Frequency of mosquitoes captured in Itacoatiara, Niterói, RJ, Brazil from human, canine and feline baits, from March 1995 to February 1996

Species	Frequency	%
Aedes taeniorhynchus (Wiedemann)	1,168	30.0
Culex quinquefasciatus Say	876	22.5
Aedes scapularis (Rondani)	756	19.4
Culex declarator Dyar & Knab	660	17.0
Culex nigripalpus Theobald	121	3.1
Aedes albopictus (Skuse)	109	2.8
Wyeomyia bourrouli (Lutz)	45	1.2
Phoniomyia spp.[a]	38	1.0
Culex bidens Dyar	30	0.8
Culex coronator Dyar & Knab	28	0.7
Culex pilosus (Dyar & Knab)	19	0.5
Culex saltanensis Dyar	18	0.5
Limatus durhami Theobald	6	0.2
Culex lygrus Root	3	0.1
Psorophora sp.	3	0.1
Rhunchomyia sp.	3	0.1
Aedeomyia squamipennis (Lynch Arribalzaga)	1	-[b]
Anopheles aquasalis Curry	1	-[b]
Coquellettidia venezuelensis (Theobald)	1	-[b]
Mansonia titillans (Walker)	1	-[b]
Wyeomyia confusa (Lutz)	1	-[b]
Total	3,888	100

a: including *Ph. davisi* Lane & Cerqueira, *Ph. deanei* Lourenço-de-Oliveira and *Ph. edwardsi* Lane & Cerqueira; *b*: less than 0.1%.

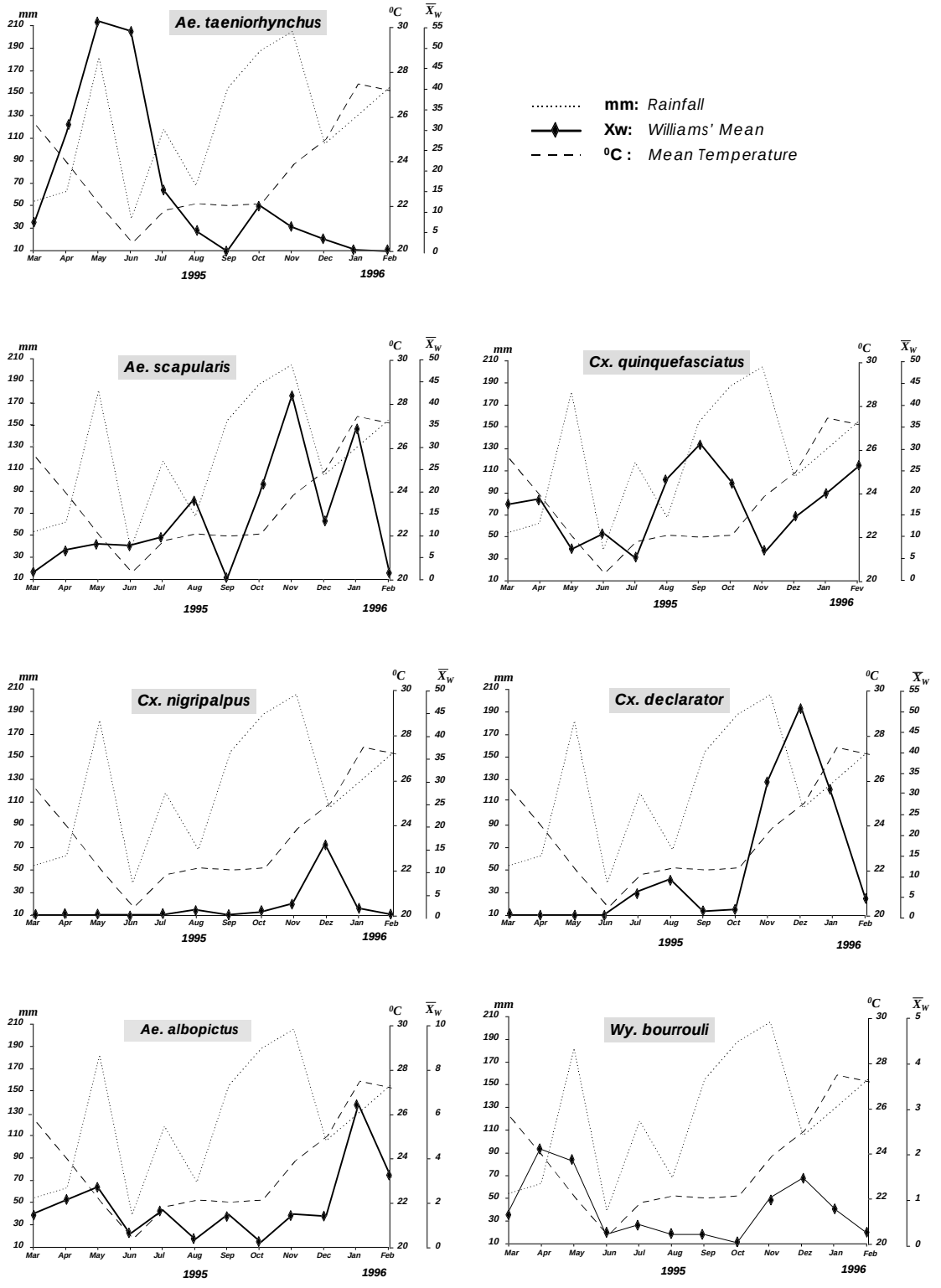

Fig. 2: monthly Williams' means of the seven most frequently collected mosquito species on canine, feline and human baits, at Itacoatiara, Niterói, Rio de Janeiro, Brazil (Note that there are different scales).

TABLE II

Monthly distribution of females of the most frequent mosquito species captured on canine bait in Itacoatiara, Niterói, RJ, Brazil, from March 1995 to February 1996

		1995										1996	
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Aedes	Freq.	4	74	31	46	20	4	0	9	3	4	0	0
taeniorhynchus	Xw	0.68	3.57	5.88	10.82	3.29	0.68	0	2.09	0.32	0.86	0	0
Culex	Freq.	28	39	16	26	14	50	93	73	18	41	44	32
quinquefasciatus	Xw	6.0	8.72	2.76	6.29	2.55	9.06	17.62	17.1	3.7	10.09	10.28	6.83
Ae. scapularis	Freq.	1	8	4	2	8	12	0	27	19	3	6	0
	Xw	0.19	1.4	0.74	0.41	0.99	1.98	0	6.33	4.34	0.57	1.21	0
Cx. declarator	Freq.	0	0	0	1	30	22	2	5	131	128	77	7
	Xw	0	0	0	0.19	3.68	4.37	0.32	1.06	24.12	26.7	14.49	1.37
Cx. nigripalpus	Freq.	0	0	1	0	1	6	0	4	16	39	5	0
	Xw	0	0	0.19	0	0.19	1.21	0	0.86	1.74	9.11	1.06	0
Ae. albopictus	Freq.	0	0	0	0	0	0	0	0	0	0	0	0
	Xw	0	0	0	0	0	0	0	0	0	0	0	0
Wyeomyia	Freq.	0	0	1	0	0	0	0	0	0	0	0	0
bourrouli	Xw	0	0	0.19	0	0	0	0	0	0	0	0	0

Freq: frequency; Xw: Williams'mean.

TABLE III

Monthly distribution of females of the most frequent mosquito species captured on feline bait in Itacoatiara, Niterói, RJ, Brazil, from March 1995 to February 1996

		1995										1996	
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Aedes	Freq.	2	2	2	1	1	1	0	0	0	0	0	0
taeniorhynchus	Xw	0.41	0.32	0.32	0.19	0.19	0.19	0	0	0	0	0	0
Culex	Freq.	43	34	18	15	6	31	49	19	7	20	34	65
quinquefasciatus	Xw	9.35	7.76	3.41	2.93	1.45	7.32	10.55	3.98	1.45	3.98	7.03	15.98
Ae. scapularis	Freq.	1	0	0	0	0	1	1	4	4	0	2	0
	Xw	0.19	0	0	0	0	0.19	0.19	0.41	0.86	0	0.32	0
Cx. declarator	Freq.	0	0	0	0	5	17	3	1	32	131	545	10
	Xw	0	0	0	0	1.06	3.47	0.57	0.19	6.99	21.91	11.96	2.31
Cx. nigripalpus	Freq.	0	0	0	1	0	0	1	0	6	29	5	2
	Xw	0	0	0	0.19	0	0	0.19	0	0.86	4.69	0.57	0.32
Ae. albopictus	Freq.	0	1	0	0	0	0	0	0	0	0	0	0
	Xw	0	0.19	0	0	0	0	0	0	0	0	0	0
Wyeomyia	Freq.	1	0	1	0	0	0	0	0	1	0	0	0
bourrouli	Xw	0.19	0	0.19	0	0	0	0	0	0.19	0	0	0

Freq.: frequency; Xw: Williams'mean.

significant (a=1%) positive correlation. When they were correlated with the rainfall, no species had a significant level of correlation, although *Ae. scapularis* showed population increases following a rise in rainfall, especially when the mean temperature was above 22°C (Fig. 2).

DISCUSSION

When considering their monthly frequencies during the year, *Ae. taeniorhynchus* showed only one population peak (April-June), while *Ae. scapularis* showed a multivoltine pattern with higher density from August to January, although it

TABLE IV

Monthly distribution of females of the most frequent mosquito species captured on human bait in Itacoatiara, Niterói, RJ, Brazil, from March 1995 to February 1996

		1995										1996	
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Aedes taeniorhynchus	Freq.	44	374	198	174	77	28	0	35	21	11	2	0
	Xw	5.02	25.3	46.59	40.2	111.88	4.37	0	8.6	5.09	1.82	0.32	0
Culex quinquefasciatus	Freq.	2	4	0	3	3	15	11	3	3	1	5	11
	Xw	0.41	0.5	0	0.57	0.68	2.76	0.86	0.68	0.57	0.19	1.06	2.47
Ae. scapularis	Freq.	6	33	37	35	49	82	2	54	153	53	141	8
	Xw	0.97	5.72	7.81	7.76	8.72	16.28	0.32	11.88	35.94	12.41	33.08	1.51
Cx. declarator	Freq.	0	0	0	0	0	1	0	0	1	1	1	0
	Xw	0	0	0	0	0	0.19	0	0	0.19	0.19	0.19	0
Cx. nigripalpus	Freq.	0	0	0	1	0	1	0	0	2	0	1	0
	Xw	0	0	0	0.19	0	0.19	0	0	0.41	0	0.19	0
Ae. albopictus	Freq.	9	10	12	3	8	2	6	1	10	7	27	13
	Xw	1.54	1.92	2.09	0.57	1.63	0.32	1.45	0.19	1.45	1.37	6.20	3.12
Wyeomyia bourrouli	Freq.	5	9	8	1	2	1	1	0	3	6	4	1
	Xw	0.57	2.09	1.29	0.19	0.41	0.19	0.19	0	0.68	1.45	0.74	0.19

Freq.: frequency; Xw: Williams'mean.

TABLE V

Total number of female mosquitoes from the most frequent species captured on dog, cat and human baits in Itacoatiara, Niterói, RJ, Brazil, from March 1995 to February 1996

Bait	Species							
	Aedes taeniorhynchus	*Culex quinquefasciatus*	*Ae. scapularis*	*Cx. declarator*	*Cx. nigripalpus*	*Ae.*[b] *albopictus*	*Wyeomyia*[b] *bourrouli*	Total
Dog	195	474	90	403	72	0	1	1,235
Cat	9	341	13	253	44	1	3	664
Sig.	++	++	++	++	+	-	-	-
Man[a]	964	61	653	4	5	108	41	1,836
Total	1,168	876	756	660	121	109	45	3,735

a: two humans. These data were not analyzed statistically due to methodological differences; *b:* not compared statistically due to the small number of individuals captured; Sig.: significance level; +: significant at $p < 0.05$; ++: significant at $p < 0.01$.

TABLE VI

Number of female mosquitoes from the most frequent species captured on dog, cat and human baits during dawn, dusk and afternoon in Itacoatiara, Niterói, RJ, Brazil, from March 1995 to February 1996

Period / Species	Dawn	Dusk	Sig.	Afternoon[a]
Aedes taeniorhynchus	130	530	++	508
Culex quinquefasciatus	32	844	++	0
Ae. scapularis	169	430	++	157
Cx. declarator	6	654	++	0
Cx. nigripalpus	4	117	++	0
Ae. albopictus [b]	35	47	-	27
Wyeomyia bourrouli [b]	25	5	-	15
Total	401	2,627	-	707

a: data for afternoon were not analyzed statistically due to methodological differences, and also because fewer hours were spent with capture; *b:* not compared statistically due to the small number of individuals caught; Sig.: significance level; ++: significant at $p < 0.01$.

TABLE VII

Number of female mosquitoes from the most frequent species captured on dog (D), cat (C) and human (H) baits during dawn, afternoon and dusk, in Itacoatiara, Niterói, RJ, Brazil, from March 1995 to February 1996

	Dawn			Afternoon			Dusk		
	D	C	H	D	C	H	D	C	H
Ae. taeniorhynchus	13	5	112	154	0	354	28	4	498
Cx. quinquefasciatus	17	15	0	0	0	0	457	326	61
Ae. scapularis	9	3	157	52	0	105	29	10	391
Cx. declarator	5	1	0	0	0	0	398	252	4
Cx. nigripalpus	3	0	1	0	0	0	69	44	4
Ae. albopictus	0	0	35	0	0	27	0	1	46
Wy. bourrouli	0	0	25	1	2	12	0	1	4
Total	47	24	330	206	2	498	981	638	1,008

Ae: Aedes; Cx: Culex; Wy: Wyeomyia.

was captured throughout the year (Fig. 2). This phenomenon was similar to the one described by Lourenço-de-Oliveira et al. (1985) in a coastal lowland heartworm enzootic area of the city of Rio de Janeiro.

Cx. quinquefasciatus also demonstrated a multivoltine pattern and was captured year-round. *Cx. declarator* had a monthly frequency similar to *Cx. quinquefasciatus*, but it had only one peak in numbers during the year (November-January).

Mosquitoes were attracted in higher numbers by each bait when mosquito densities were greatest, despite any interference of individual baits (Tables II, III, IV). Overall, mosquitoes were attracted to the animals according to their own preferences, but always in proportion with its population density. As stated by other workers, in order to be a heartworm vector, besides being resistant to infection but yet susceptible enough to allow larvae development, a mosquito species must feed on dogs, be well adapted to the region and be abundant and preferably multivoltine (Ludlam et al. 1970, Christensen 1977, 1978, 1981, Otto & Jachowski 1980). Accordingly, the four species mentioned above could be looked upon as those most likely to be significant vectors of dirofilariasis, especially the two species with multivoltine patterns.

Ae. albopictus and *Wy. bourrouli* preferred humans to either dog or cat (Table V), and were infrequently captured on either of the animal baits. This suggests that these two species are not primary vectors of *D. immitis*. Nevertheless, attention must be given to *Ae. albopictus*, a species captured in small numbers, but present year-round and showing a positive correlation between it's densities and rainfall (Fig. 2). This species, recently reintroduced into Brazil, is reported to be a vector of dirofilariasis in the USA and Japan (Kartman 1953, Apperson et al. 1989, Konishi 1989a, b).

When comparing the attractiveness of the dog and cat to mosquitoes, the larger number of captures were always from the dog, despite species composition. *Ae. taeniorhynchus* and *Ae. scapularis* were collected more frequently from the dog and much less than the cat. Even though the dog was more attractive than the cat to *Cx. quinquefasciatus*, *Cx. declarator* and *Cx. nigripalpus*, the cat did attract these species to some extent, specially *Cx. quinquefasciatus* (Table V). In Italy, according to Genchi et al. (1992), *Cx. pipiens*, a closely related species to *Cx. quinquefasciatus*, was the mosquito species most commonly associated with cats as well as dogs, which strengthens the possibility of members of the genus *Culex* being the potential vectors of *D. immitis* parasite to cats.

It should be pointed out that *Ae. taeniorhynchus* and *Ae. scapularis* were collected in large numbers in human-bait, while *Culex* species were collected much less frequently (Table V). This may be partially attributed to baits standing outdoors and under lighted conditions, while *Cx. quinquefasciatus* are endophilic and nocturnal (Deane 1951, Rachou 1956) and to *Aedes* species being exophilic, aggressive, opportunistic and persistent blood-seekers (Rachou 1956, Forattini 1965, Edman & Bidlingmayer 1969). It is important to note that the possible vectors of canine heartworm were attracted to humans, hence humans are exposed to dirofilariasis.

Ae. taeniorhynchus, *Cx. quinquefasciatus*, *Ae. scapularis*, *Cx. declarator* and *Cx. nigripalpus* were more active during dusk when compared to dawn for all baits (Tables VI, VII). *Culex* species showed marked crepuscular activity while *Aedes* species were captured at daytime, although in smaller numbers when compared to dusk, such as noted before (Rachou 1956, Edman & Bidlingmayer 1969, Lourenço-de-Oliveira & da-Silva 1985).

Heartworm disease in dogs in Rio de Janeiro is frequently reported in rural, suburban or urbanizing localities where wild and hemisynanthropic mosquito species are present. In urban localities of the State, where *Cx. quinquefasciatus* and *Ae. aegypti* are pratically the only species collected, the prevalence of canine heartworm is very low. For instance, in urban areas in the city of Rio de Janeiro, where *Cx. quinquefasciatus* accounts for almost 94% of the mosquitoes collected in light traps, only 4.6% of dogs were infected. But the prevalence of heartworm disease increases to 12.5% in urbanizing districts within the city, where *Cx. quinquefasciatus* accounts for only 58%, while *Ae. scapularis* and the other mosquito species account for 25% and 17%, respectively (FEEMA 1983, Labarthe et al. 1992, Souza 1992). Additionally, in contrast to the above districts, the prevalence of the disease increases to 52.5% in localities of low demographic density of the State (Labarthe et al. 1997a), such as Itacoatiara, where *Cx. quinquefasciatus* accounts for only 25.5% of the total mosquitoes collected, while *Ae. taeniorhynchus* and *Ae. scapularis* account for approximately 30% and 20%, respectively (Table I). These data suggest that wild and hemisynanthropic mosquito species such as *Ae. taeniorhynchus*, *Ae. scapularis*, *Cx. declarator* and *Cx. nigripalpus* might be the principal vectors of *D. immitis*, while the endophilic *Cx. quinquefasciatus* seems likely to be, at most, a secondary vector. *Ae. taeniorhynchus* and *Ae. scapularis* have already been identified as potential vectors of *D. immitis* in Rio de Janeiro (Lourenço-de-Oliveira & Deane 1995), and *Ae. taeniorhynchus* is considered a vector in the Americas (Sauerman & Nayar 1983, Parker 1986, 1993, Lowrie 1991). *Cx. declarator* has never been mentioned as a potential vector of heartworm. *Cx. nigripalpus* has been reported to be a vector (Sauerman & Nayar 1983). *Cx. quinquefasciatus* is considered a competent vector by some workers (Kartman 1953, Villavaso & Steelman 1970, Sauerman & Nayar 1983, Russel 1985, Lowrie 1991) and as a secondary vector by others (Loftin et al. 1995). Despite being susceptible to *D. immitis* parasites (McCall et al. 1992), cats in the State of Rio de Janeiro are rarely infected. This may be partially explained by (1) the vector feeding behavior, since mosquitoes were most frequently collected from dogs, (2) the inability of cats to transmit filarial parasites to mosquitoes because of their low blood microfilaremia, (3) the distribution of mosquito species that bite cats at greater frequencies do not coincide with heartworm prevalence in the State of Rio de Janeiro, and (4) dogs are the principal reservoir host for transmission of the parasites to vector mosquitoes.

ACKNOWLEDGMENTS

To Monique Albuquerque Motta and Luciana R Barros for their help in identifying the *Wyeomyia* and *Phoniomyia* species. To Prof. Pedro Carvalho Rodrigues and Luciene Rodrigues Carvalho for performing the statistical analysis. To Ana Duék for reviewing of the manuscript and to Mara Lemos for the map.

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